# CHAPTER 4
# FUTURE COST OF EWA SPOT MARKET WATER PURCHASES

This chapter discusses the potential future cost of EWA water supplies in relation to the acquisition of water on California's water transfer market. The chapter begins with background information on the EWA program, including a summary of its objectives and anticipated long-term implementation. It further describes the characteristics of the water transfer market and identifies key assumptions related to estimating future changes in the cost of supplies acquired on the spot market. It concludes with a preliminary estimate of the potential range of water costs, and recommendations for future work to support the LVE.

## BACKGROUND

The Delta is the largest estuary on the West Coast and provides essential habitat for a diverse array of fish and wildlife. A variety of factors have potentially contributed to the decline of fish species in the Delta, including loss of habitat, water quality degradation, and water resources development, resulting in the listing of various species as threatened or endangered. In response to environmental changes and species listings, several programs and practices to address Delta fisheries and water quality have been developed, such as the CVPIA (b)(2), the SWRCB Water Right Decision 1641, various CALFED programs, and the Vernalis Adaptive Management Plan (VAMP). However, pumping curtailments and other actions in the Delta that have been beneficial to fish often have had adverse impacts on cities, farms, and businesses that depend on water supplies pumped from or through the Delta. Consequently, the EWA was developed to provide water project operators with additional flexibility in meeting or exceeding flow, water quality, and fishery protection objectives in the Delta.

The EWA was identified as one of several program elements in the CALFED ROD. It is a cooperative management program that allows resource agencies to protect at-risk fish species in the Delta through environmentally beneficial changes in CVP/SWP pumping operations at no uncompensated water cost to project water users. Currently, the EWA relies primarily on water acquisitions and transfers to obtain targeted supplies, using the supplies to replace deliveries interrupted by actions taken to benefit fish. Originally a 4-year program (2001 to 2004), the EWA agencies signed a Memorandum of Understanding in September 2004 extending the "short-term" or pilot program through 2007.

**EWA Participating Agencies**

- Bureau of Reclamation
- California Department of Water Resources
- U.S. Fish and Wildlife Service
- National Oceanic and Atmospheric Administration, National Marine Fisheries Service
- California Department of Fish and Game

### Purpose and Objectives of EWA Program

The EWA is authorized to use acquired water assets to (1) augment instream flows and Delta outflows, (2) modify or reduce water exports to benefit fisheries, and (3) replace

regular project water supply reduced by pumping curtailments at Banks and Tracy pumping plants.

The EWA buys water from willing sellers or diverts surplus water when safe for fish, then banks, stores, transfers, and releases the water as needed to protect fish and to compensate water users. EWA implementing agencies have developed water acquisition targets (based on south-of-Delta delivery) for a long-term EWA operation. Typically, the EWA Program purchases 200,000 to 300,000 acre-feet of water annually.

## EWA Operations

The EWA primarily uses Banks Pumping Plant to move water south of the Delta. The EWA has 500 cfs (about 60 TAF annually) dedicated capacity at Banks from July through September, above the 6,680 cfs maximum pumping capacity. In wet years, the CVP and SWP use all remaining Banks available capacity, while in dry years the EWA is often afforded some added capacity. When water cannot be conveyed through the Delta, the EWA will typically try to store water in CVP or SWP reservoirs until the summer transfer season begins.

The EWA incurs debt to the CVP/SWP from December through June, and returns water to the CVP/SWP from July through September, sometimes later. Sellers provide some storage until transfers begin in July, and the EWA can store assets in CVP and SWP reservoirs (primarily San Luis, Folsom, and Oroville reservoirs). The EWA can store water in these reservoirs to the extent that space is available; when a reservoir spills, EWA assets are converted to project supplies and are no longer available to offset pumping curtailments or for use in taking other EWA actions. The EWA has also pursued source-shifting and exchanges. For example, the EWA pursued dry-wet exchanges with Metropolitan Water District of Southern California (MWD) in 2005. The EWA can also store water in groundwater banks, but has avoided this option because it is currently more expensive and recharge/extraction rates are limited.

## Expected Future EWA Without-Project Conditions

It is expected that the EWA, or a similar water acquisition program, will continue into the future. Federal legislation enacted in October 2004 authorized appropriations for the EWA for 6 years. Reclamation is leading development of an EIS/EIR anticipated to be completed by fall 2007 for the proposed long-term program. The proposed long-term EWA is likely to be an acquisitions-based program similar to the short-term EWA. Although the EWA is not funded beyond 2007, it is believed that the need for the EWA, or a similar program to promote protection and restoration of Delta fisheries, will continue into the long-term future. **Table 4.1** summarizes existing EWA water acquisition targets by year type (based on current OCAP assumptions).

Currently, the EWA is granted 500 cfs dedicated pumping capacity at Banks between July and September, which is considered in addition to the maximum pumping capacity of 6,680 cfs. If pumping is increased at Banks to 8,500 cfs, this total capacity would include the 500 cfs capacity dedicated to the EWA. In general, with pumping increased to 8,500 cfs at Banks, the EWA would need to buy more water to facilitate pumping curtailments. This increase amounts to about 20 TAF per year, on average, according to OCAP.

**TABLE 4.1**
**EWA ACQUISITIONS BY YEAR TYPE**

| Year Type (40-30-30) | North-of-Delta Acquisitions (TAF) | South-of-Delta Acquisitions (TAF) | Total (TAF) |
|---|---|---|---|
| **Wet** | 0 | 250 | 250 |
| **Above Normal** | 47.3 | 202.7 | 250 |
| **Below Normal** | 47.3 | 202.7 | 250 |
| **Dry** | 105.7 | 124.3 | 230 |
| **Critical** | 153.2 | 56.8 | 210 |

KEY: EWA = Environmental Water Account TAF = thousand acre-feet

*Source: CALSIM II EWA acquisition quantities in Common Assumptions Plan Formulation Package, based on OCAP, 2020 level of development.*

The long-term EWA is seeking to diversify its assets and enter into longer-term water transfer agreements, such as the proposed water purchase agreement with Yuba County Water Agency under the proposed Lower Yuba River Accord. Source-shifting and exchanges may become more difficult for the EWA in the future as water transfers increase and conveyance limitations intensify. For example, dry/wet transfers may become more difficult due to increased movement of transfer water throughout the year (not just during the peak transfer season) and related conveyance constraints.

## CHARACTERIZATION OF CALIFORNIA'S WATER MARKET

California's water market developed as a result of the last major drought in California (1987 to 1992) and Federal and State legislation pertaining to water rights and entitlements. Passage of the CVPIA in 1992 and negotiation of the "Monterey Agreement" in 1996 changed the operating rules of CVP and SWP allocations, respectively, and induced the development of an active water transfer market within California's two major water projects. Water transfers occur both within the CVP and SWP and with external water agencies. In recent years, extensive transfers of water through the Delta have occurred.

Environmental water demands have increased significantly over the past decade, particularly in the Delta. Primarily in response to environmental legislation and regulatory requirements, both the Federal and State governments have developed programs to reallocate and/or purchase water for environmental purposes. These programs include Reclamation's Water Acquisition Program (WAP) and Water Transfer Program (WTP) pursuant to the CVPIA, and the EWA. As a result, programs that acquire water for environmental purposes have a significant effect on California's water market.

Agricultural water districts are increasingly entering the California water market, where they can sell portions of their supplies to urban users at higher prices to help maintain affordable supplies to farmers. Because agricultural users retain contract entitlements or water rights to the majority of California's water supplies, many urban water agencies in the State are negotiating agreements with agricultural users to meet growing M&I demands. Real estate developers, in seeking to comply

with recent laws requiring new developments to secure adequate water supplies, also are entering the market in search of agricultural water rights and long-term transfers.

In the future, California's water market also may be affected by water-related grant programs, such as Proposition 50. Passed by California voters in November 2002, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act (Proposition 50) has dedicated over $1.5 billion to CALFED and other programs focused on improving water supply reliability.

Water transactions in the State generally fall into one of three categories: permanent sales of water rights or entitlements, long-term transfers, or short-term transfers (spot market). Transfers are distinguished as north of the Delta or south of the Delta. South-of-Delta (export service area) includes areas served by the CVP and SWP Delta pumping facilities, encompassing agricultural and urban development in the Central Valley and central and southern coasts.

## Permanent Sales and Long-Term Transfers

Permanent sales and long-term transfers are often characterized by the permanent or temporary reallocation of water from agricultural to urban or environmental uses (usually through temporary or long-term land fallowing). Examples of recent permanent sales of CVP and SWP contract supplies are included in **Table 4.2**. Although sales prices vary, the price of permanent contract sales has increased over the last decade.

**TABLE 4.2**
**RECENT CVP AND SWP WATER CONTRACT SALES**

| Year | Buyer | Seller | Type | Quantity (AF) | Price $/AF |
|---|---|---|---|---|---|
| 2004 | Westlands WD | Widren WD | CVP | 2,990 | $1,500 |
| 2004 | Westlands WD | Centinella WD | CVP | 2,500 | $1,400 |
| 2003 | West Kern WD | Berrenda Mesa WD | SWP | 6,000 | $1,000 |
| 2003 | Lemoore Naval Military Base | Tulare lake Basin WSD | SWP | 5,000 | $2,150 |
| 2003 | Coachella Valley WD | Tulare Lake Basin WSD | SWP | 9,900 | $2,150 |
| 2002 | City of Tracy | Banta Carbona ID | CVP | 2,500 | $1,000 |
| 2002 | City of Tracy | West Side ID | CVP | 5,000 | $1,000 |
| 2002 | Zone 7 | Tulare Lake Basin WSD | SWP | 400 | $1,600 |
| 2002 | Zone 7 | Belridge WSD | SWP | 2,219 | $1,500 |

KEY: AF = acre-feet; CVP = Central Valley Project; ID = Irrigation District; SWP = State Water Project; WD = Water District; WSD = Water Storage District

*Notes: Reliability of supplies varies, but is typically moderate to high. Prices presented represent the capital outlay to purchase the water contract from the current holder, and do not include future payments for the contracted supplies.*

Long-term transfers differ from permanent sales in that the seller retains the underlying water right. Examples of recent long-term water purchases are included in **Table 4.3**. As shown in the table, historic long-term transfers have varied significantly by region (north of the Delta versus south of the Delta), volume, reliability, and price. South-of-Delta transfers with a high reliability (such as those purchased by the cities of Lodi, Tracy, Lathrop, Manteca, and Escalon, and Newhall Land and Farming) account for the highest prices on the long-term transfer market. The unit price of

permanent contract sales and long-term transfers cannot be directly compared with annual spot market transfers without taking into account the volume of the transfer, reliability of the supply, and duration of the transaction. However, increases in historical prices appear to be occurring at a rate above inflation.

**TABLE 4.3**
**RECENT AND PROPOSED LONG-TERM WATER PURCHASES**

| Year[4] | Buyer | Seller | Water Source | Length | Quantity (AF/yr) | Reported Price ($/AF)[1] |
|---|---|---|---|---|---|---|
| 2005[2] | DWR & CVP | Yuba County Water Agency | NOD | 9 years | Varies by Year Type<br>Wet, AN: 63 – 80<br>BN, Dry, C: 100 – 188 | Varies by Year Type<br>Wet, AN: $25 - $60<br>BN, Dry, C: $50 - $125 |
| 2003 | City of Lodi | Woodbridge Irrigation District | NOD | 40 years | 6,000 | $200 |
| 2003 | Cities of Tracy, Lathrop, Manteca, and Escalon | South San Joaquin Irrigation District | SOD | 30 years | 43,090 | $191 |
| 2003 | Newhall Land and Farming Co. | Nickel Family | SOD | 30 years | 1,600 | $475 |
| 2000[3] | CCWD | East Contra Costa Irrigation District | NOD | Permanent | 8,200 | $27 |
| 2000 | Northridge Water District | Placer County Water Agency | NOD | 15 years | 12,000 | $35 |
| 1999 | Reclamation | San Joaquin River Group Authority | SOD | 10 years | Varies<br>11,000 - 110,000 | Varies<br>$27 - $60 |
| 1997 | MWD | Arvin Edison Water Storage District | SOD | 25 years | 50,000 | $165 |

KEY:
AF = acre-feet
AN = above normal
BN = below normal
C = critical
CCWD = Contra Costa Water District
CVP = Central Valley Project
DWR = Department of Water Resources
MWD = Metropolitan Water District of Southern California
NOD = north of the Delta
SOD = south of the Delta

*Notes:*

1. *Unit price excludes additional costs associated with conveyance/delivery of the supplies to the buyer. Price does not reflect the reliability of the supplies, which varies.*
2. *This transfer is proposed as part of the Lower Yuba River Accord, pending completion of a final EIS/EIR.*
3. *Water can only be used within the East Contra Costa Irrigation District service area (not an out-of-basin transfer).*
4. *Table excludes recent transfers from out-of-state sources (such as the Colorado River Basin).*

## Spot Market Transfers

Short-term spot market sales differ from long-term transfers in that they are negotiated and implemented within a single year. Both the number and price of short-term spot market sales have increased in recent years, particularly in dry years. Historical spot market purchases south of the Delta and north of the Delta are summarized in **Tables 4.4** and **4.5**, respectively.

## TABLE 4.4
## HISTORICAL SPOT MARKET WATER PURCHASES SOUTH OF THE DELTA

| Year | Buyer | Seller | Year Type | Quantity (AF)[2] | Price ($/AF)[2] |
|---|---|---|---|---|---|
| **2004** | EWA | Kern County WA | D | 35,000 | $190 |
| **2004** | Reclamation | Stevinson WD | D | 9,350 | $100 |
| **2004** | Reclamation | Patterson WD | D | 10,000 | $100 |
| **2004** | Reclamation | San Joaquin River Exchange Contractors | D | 80,000 | $120 |
| **2004** | Reclamation | Broadview WD | D | 5,400 | $110 |
| **2004** | Reclamation | Del Puerto WD | D | 5,000 | $65 |
| **2003** | Reclamation | Westside Mutual Water Company | BN | 10,000 | $130 |
| **2003** | EWA | Santa Clara WD | BN | 20,000 | $162 |
| **2003** | EWA | Kern County WA | BN | 125,000 | $169 |
| **2003** | Reclamation | Kern County WA | BN | 20,000 | $162 |
| **2003** | Reclamation | San Joaquin River Exchange Contractors | BN | 60,000 | $120 |
| **2003** | Reclamation | San Joaquin River Group Authority | BN | 58,064 | $74 |
| **2003** | Reclamation | San Joaquin River Group Authority | BN | 12,500 | $65 |
| **2002** | Reclamation | Lost Hills WD | D | 3,550 | $120 |
| **2002** | Reclamation | Patterson WD | D | 825 | $80 |
| **2002** | Reclamation | Banta Carbona ID | D | 4,000 | $80 |
| **2002** | EWA | Kern County WA | D | 97,400 | $181 |
| **2002** | Reclamation | San Joaquin River Exchange Contractors | D | 64,500 | $120 |
| **2002** | Reclamation | Del Puerto WD | D | 2,000 | $64 |
| **2002** | Reclamation | Broadview WD | D | 4,000 | $100 |
| **2002** | Reclamation | Banta Carbona ID | D | 2,000 | $63 |
| **2001** | Reclamation | San Luis WD | D | 3,100 | $125 |
| **2001** | EWA | Semitropic WSD, Tulare ID | D | 15,000 | $300 |
| **2001** | Reclamation | San Luis Canal Company | D | 16,000 | $150 |
| **2001** | EWA | Cawelo WD, Kern County WA | D | 5,000 | $360 |
| **2001** | EWA | Santa Clara WD, Kern County WA | D | 30,000 | $290 |
| **2001** | Reclamation | San Joaquin River Exchange Contractors | D | 49,000 | $135 |
| **2001** | EWA | Westside Mutual, Tejon-Castaic, Dudley Ridge WDs | D | 21,000 | $280 |
| **2001** | EWA | Westside Mutual Water Company | D | 15,000 | $138 |
| **2001** | EWA | Kern County WA | D | 10,000 | $280 |
| **2001** | EWA | Kern County WA | D | 10,000 | $460 |
| **2001** | EWA | Buena Vista, Rosedale, West Kern WDs | D | 23,718 | $280 |
| **2001** | EWA | Rosedale Rio Bravo WSD | D | 19,026 | $138 |
| **2001** | EWA | Arvin Edison WSD | D | 10,000 | $138 |
| **2001** | EWA | MWD | D | 50,000 | $75 |
| **2001** | Reclamation | West Stanislaus ID | D | 3,000 | $105 |
| **2001** | Reclamation | West Stanislaus ID | D | 2000 | $75 |
| **2000**[1] | Reclamation | CVP | AN | 72,280 | $138 |
| **2000** | Reclamation | San Luis Canal Company | AN | 16,500 | $125 |

## TABLE 4.4 (CONT.)
## HISTORICAL SPOT MARKET WATER PURCHASES SOUTH OF THE DELTA

| Year | Buyer | Seller | Year Type | Quantity (AF)[2] | Price ($/AF)[2] |
|---|---|---|---|---|---|
| **2000** | Reclamation | San Joaquin River Exchange Contractors | AN | 21,500 | $110 |
| **2000** | Reclamation | Tri-Valley WD | AN | 799 | $62 |
| **2000** | Reclamation | Hills Valley ID | AN | 2,324 | $61 |
| **2000** | Reclamation | County of Tulare | AN | 3,716 | $64 |
| **1999** | Reclamation | San Luis Canal Company | AN | 5,905 | $65 |
| **1999** | Reclamation | San Luis Canal Company | AN | 4,762 | $60 |
| **1999** | Stockton East WD | Oakdale and San Joaquin IDs | AN | 30,000 | $55 |
| **1999** | Reclamation | Semitropic WSD | AN | 6,112 | $25 |
| **1999** | Reclamation | San Joaquin River Exchange Contractors | AN | 20,000 | $60 |
| **1998** | Reclamation | San Joaquin River Group Authority | W | 30,000 | $15 |
| **1997** | Reclamation | San Joaquin River Exchange Contractors | W | 40,000 | $45 |
| **1997** | Reclamation | San Joaquin River Exchange Contractors | W | 10,000 | $70 |
| **1997** | Reclamation | Modesto ID | W | 5,000 | $70 |
| **1996** | Reclamation | Merced ID | W | 16,161 | $50 |
| **1996** | Reclamation | San Joaquin River Exchange Contractors | W | 30,348 | $45 |
| **1996** | Reclamation | Semitropic WSD | W | 6,047 | $25 |
| **1995** | Reclamation | Semitropic WSD | W | 5,200 | $25 |
| **1995** | Central Coast Water Authority | Reclamation | W | 13,750 | $58 |
| **1995** | Reclamation | San Joaquin River Exchange Contractors | W | 25,000 | $40 |
| **1994** | Reclamation | West Side ID | C | 691 | $34 |
| **1994** | Reclamation | San Luis Canal Company | C | 12,000 | $50 |
| **1994** | Reclamation | Widren WD | C | 12 | $39 |
| **1994** | Reclamation | West Stanislaus ID | C | 12 | $39 |
| **1994** | Reclamation | Plainview WD | C | 114 | $38 |
| **1994** | Reclamation | Patterson WD | C | 191 | $40 |
| **1994** | Reclamation | Pacheco WD | C | 28 | $38 |
| **1994** | Reclamation | Oro Loma WD | C | 57 | $37 |
| **1994** | Reclamation | Mercy Springs WD | C | 154 | $36 |
| **1994** | Reclamation | Banta Carbona ID | C | 300 | $35 |

KEY:
AF = acre-feet
EWA = Environmental Water Account
ID = Irrigation District
MWD = Metropolitan Water District of Southern California
SOD = South of the Delta
WA = Water Agency
WD = Water District
WSD = Water Storage District

1. *This water, purchased by Reclamation, was determined to be unneeded and later given to the EWA in 2001.*
2. *Prices and quantities do not include carriage losses or costs to convey water to point of use. Year types based on 60-20-20 San Joaquin River index (AN = above normal, BN= below normal, C=critical, D=dry, and W=wet).*

## TABLE 4.5
## HISTORICAL SPOT MARKET WATER PURCHASES NORTH OF THE DELTA

| Year | Buyer | Seller | Year Type | Quantity (AF) | Price ($/AF) |
|---|---|---|---|---|---|
| **2005** | Westlands Water District | Sacramento River Settlement Contractors | AN | 14,000 | $115 |
| **2005** | EWA | Yuba County WA | BN | 4,600 | $80 |
| **2004** | EWA | Placer County WA | BN | 20,000 | $83 |
| **2004** | EWA | Yuba County WA | BN | 100,000 | $88 |
| **2004** | DWR (DYWPP) | Yuba County WA | BN | 485 | $88 |
| **2003** | Reclamation (EWA) | Yuba County WA | AN | 65,000 | $85 |
| **2003** | EWA | Oroville-Wyandotte ID | AN | 4,915 | $75 |
| **2003** | MWD | Sacramento River Settlement Contractors | AN | 50,000 | $105 |
| **2003** | DWR (DYWPP) | Butte Water District | AN | 11,355 | $105 |
| **2003** | MWD | Richvale ID | AN | 15,000 | $105 |
| **2003** | MWD | Western Canal Water District | AN | 20,000 | $105 |
| **2003** | MWD | Glenn-Colusa ID | AN | 60,000 | $105 |
| **2002** | EWA | Sacramento Groundwater Authority | D | 7,145 | $75 |
| **2002** | Reclamation | Sutter Mutual Water Co. | D | 1,202 | $30 |
| **2002** | Reclamation | Reclamation District #108 | D | 2,460 | $30 |
| **2002** | Reclamation | Natomas Central Mutual Water Company | D | 855 | $30 |
| **2002** | EWA | Yuba County WA | D | 135,000 | $75 |
| **2002** | CCWD | Yuba County WA | D | 5,000 | $75 |
| **2002** | DWR (DYWPP) | Yuba County WA | D | 22,050 | $75 |
| **2002** | Central San Joaquin WCD | South San Joaquin ID | D | 20,000 | $15 |
| **2001** | EWA | Placer County WA | D | 20,000 | $75 |
| **2001** | Westlands Water District | Sacramento River Settlement Contractors | D | 160,000 | $70 |
| **2001** | DWR (DYWPP) | Western Canal Water District | D | 16,755 | $75 |
| **2001** | DWR (DYWPP) | Browns Valley ID | D | 8,000 | $75 |
| **2001** | DWR (DYWPP) | Yuba County WD | D | 114,050 | $75 |
| **2001** | EWA | Merced ID | D | 25,000 | $75 |
| **2001** | EWA | Yuba County WD | D | 50,000 | $100 |
| **2000** | Reclamation | Merced ID | AN | 24,748 | $60 |
| **2000** | EWA | Oroville-Wyandotte ID | AN | 10,000 | $75 |
| **2000** | CCWD | Western Water Co. | AN | 8,180 | $65 |
| **1999** | Sacramento County WA | Browns Valley ID | W | 1,000 | $50 |
| **1999** | Reclamation | Oakdale & South San Joaquin IDs | AN | 50,000 | $60 |
| **1998** | Reclamation | Corning, Proberta, Thomes Creek WDs | W | 4,800 | $38 |
| **1997** | Reclamation | Yuba County WA | W | 25,000 | $50 |
| **1996** | Sacramento County WA | Browns Valley ID | W | 2,000 | $75 |
| **1995** | Reclamation | Sacramento River Water Contractors | W | 57,809 | $36 |
| **1994** | Various SWP Users | DWR | C | 115,083 | $67.50 |
| **1994** | Reclamation | Oakdale & South San Joaquin IDs | C | 33,119 | $50 |

**TABLE 4.5 (CONT.)**
**HISTORICAL SPOT MARKET WATER PURCHASES NORTH OF THE DELTA**

| Year | Buyer | Seller | Year Type | Quantity (AF) | Price ($/AF) |
|---|---|---|---|---|---|
| **1994** | Reclamation | Oakdale & South San Joaquin IDs | C | 15,000 | $50 |
| **1994** | Reclamation | Merced ID | C | 15,000 | $50 |
| **1994** | Reclamation | Merced ID | C | 13,450 | $50 |
| **1994** | Reclamation | CA Department of Fish and Game | C | 15,855 | $24 |

KEY: AF = acre-feet; ID = Irrigation District; CCWD = Contra Costa Water District; MWD = Metropolitan Water District of Southern California; DWR = Department of Water Resources; SWP = State Water Project; DYWPP = Dry Year Water Purchase Program; WA = Water Agency; EWA = Environmental Water Account; WCD = Water Conservation District

*Notes: Prices and quantities do not include carriage losses or costs to convey water to point of use. Year types based on 40-30-30 Sacramento River index (AN = above normal, BN= below normal, C=critical, D=dry, and W=wet).*

Information in these tables is based on existing and available information and may not include all historic transfers. In addition, costs do not include carriage losses, Delta or other pumping costs, or other delivery costs required to convey water to the point of use. It is provided for the purpose of illustrating general trends in the cost, frequency, location, and volume of spot market transfers over the past decade. Sources include Reclamation's Water Acquisition Program (http://www.usbr.gov/mp/ cvpia/3406b3_wap/index.html), DWR's State Water Transfer Office (http://wto.water.ca.gov), information developed by the SWRCB, and various CALFED reports.

SWP contractors are restricted in that they are not allowed to directly purchase or sell unused SWP supplies contractor-to-contractor. The SWP Turnback Pool was created to facilitate the annual sale of unneeded Table A allocations back to SWP contractors. DWR determines the price of water in the Turnback Pool, which has remained relatively constant in recent years. Because it is essentially a closed market, the Turnback Pool has a relatively small impact on the price of spot market water. However, it does influence the demand for transfers by SWP water users in the greater spot market, particularly in wet years.

The majority of transactions on the spot market have been for environmental purposes, although the volume of these transfers has often been small. The WAP is a joint effort by Reclamation and the U.S. Fish and Wildlife Service to acquire water supplies to meet the habitat restoration and enhancement goals of the CVPIA and to improve Reclamation's ability to meet regulatory water quality requirements. Reclamation has made annual spot market purchases for the WAP since 1994, targeting up to 163,000 acre-feet annually. The WAP has historically limited itself to annual transfers due to the Federal appropriations cycle. The price of these purchases has ranged from $15 per acre-foot to $150 per acre-foot. These prices may be lower than typical south-of-Delta spot market purchases because they are part of a mandated settlement. The majority of WAP purchases has been from within the CVP. WAP purchases have been limited in recent years by financial constraints and the increasing cost of water.

With the exception of the proposed transfer as part of the Lower Yuba River Accord, the EWA historically has purchased its supplies annually from the spot market. This generally has allowed the program to adjust to current year hydrologic and environmental conditions and reduce spills of

EWA supplies stored in CVP and SWP reservoirs. Initial EWA water acquisitions in 2001 were the most costly, largely because the program purchased two-thirds of its total water supplies from sources south of the Delta. In subsequent years, the program has adjusted its purchasing strategy to purchase more water from sources north of the Delta and has sought larger purchase volumes from fewer sellers. The price of EWA water purchased on the spot market has varied from $65 to $460 per acre-foot.

As shown in **Tables 4.4** and **4.5**, the EWA has paid more (on average) for its spot market supplies than the WAP. One reason may be that the WAP has the ability to purchase water directly from CVP contractors south of the Delta, while the EWA is restricted from purchasing Table A supplies directly from SWP contractors. As a result, many of the EWA's south-of-Delta purchases have been from stored supplies (such as Kern County groundwater banks), which include additional storage and conveyance costs. In addition, early EWA acquisitions targeted more costly south-of-Delta purchases; more recently, the program has adjusted its purchasing strategy to purchase water north of the Delta and is seeking longer-term transfer agreements.

Although a detailed statistical analysis was not performed for the purpose of this initial economic evaluation, spot market prices appear to have risen at a rate higher than normal inflation in recent years. As shown in **Figure 4.1**, prices for water purchases south of the Delta have typically been higher than for purchases north of the Delta, particularly in recent years. South-of-Delta transactions by water year type are shown in **Figure 4.2**. The figure also illustrates the relative increase in the number of spot market transactions, a trend that is expected to continue in the future as urban water users enter the market to meet growing demands. Because the spot market has only been established for a little over a decade, it is difficult to assess the influence of water year type and the volume of transactions on spot market prices.

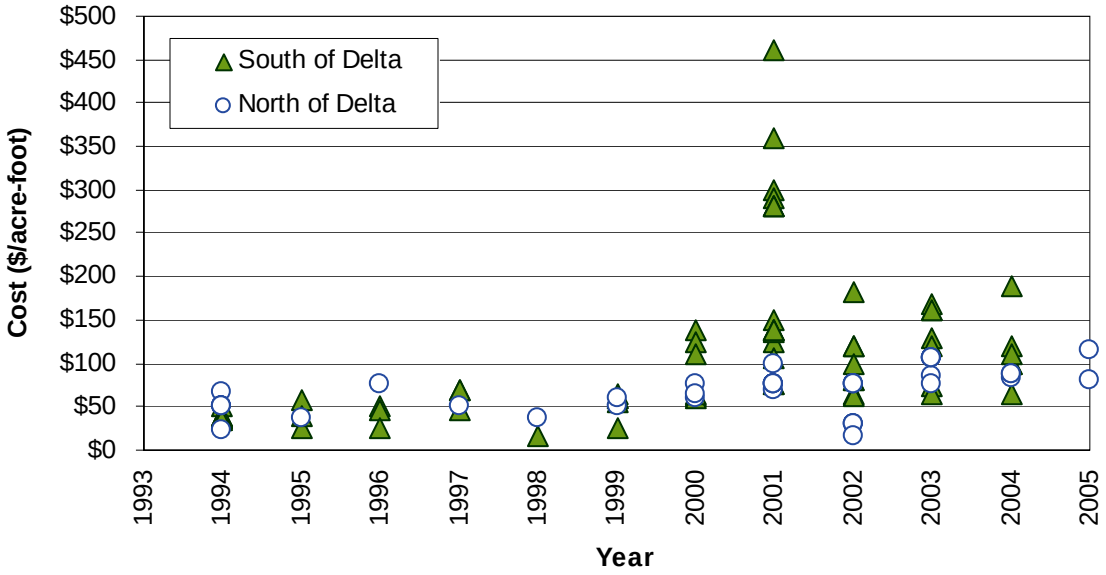


**FIGURE 4.1 – COMPARISON OF HISTORICAL SPOT MARKET WATER PRICES NORTH OF THE DELTA AND SOUTH OF THE DELTA**

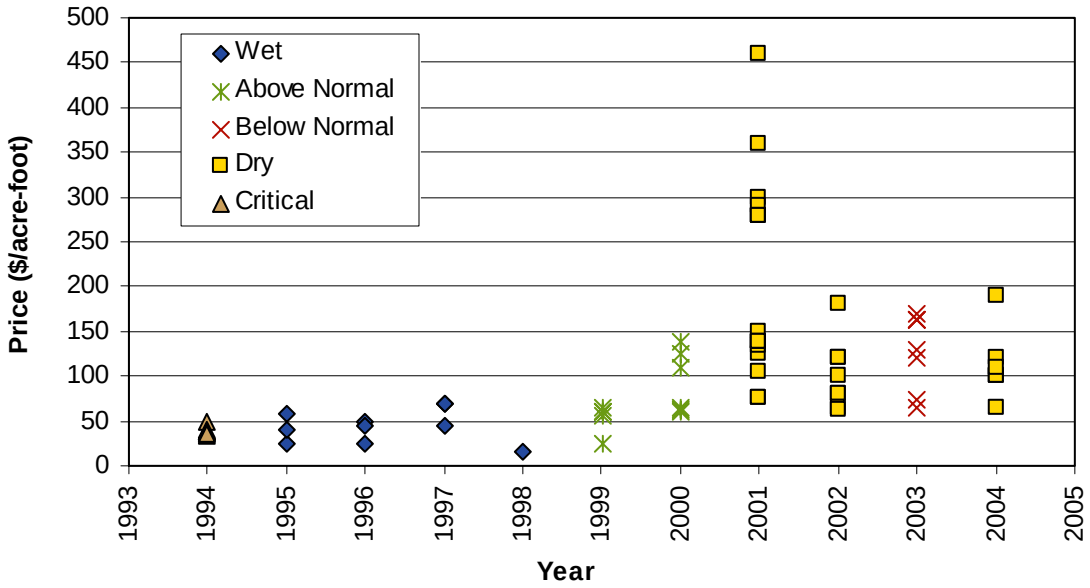


**FIGURE 4.2 – COMPARISON OF HISTORICAL SPOT MARKET WATER PRICES SOUTH OF THE DELTA BY YEAR TYPE**

## Factors Influencing the Spot Market

The following sections discuss various factors that influence the price of water on the spot market, including demand, supply, and conveyance constraints.

### *Demand Considerations*

Water demand considerations for environmental, agricultural, and urban water uses are summarized below.

*Environmental*

Environmental water demands have increased significantly over the past decade, particularly in the Delta. Primarily in response to environmental legislation and regulatory requirements, both the Federal and State governments have developed programs to reallocate and/or purchase water for environmental purposes. These programs include the CVPIA, Reclamation's WAP, the EWA, and others. As a result, programs that acquire water for environmental purposes have a significant effect on California's water transfer market. It is anticipated that the desire to purchase water for environmental purposes will continue into the future. The 2005 California Water Plan Update (Bulletin 160-05)(DWR) notes an estimate by Environmental Defense of well over 900 TAF per year in potentially unmet environmental water needs (primarily to achieve mandated instream flows). DWR included varying environmental water needs in the water demand scenarios presented in the 2005 Water Plan Update; environmental water demand increases for the three demand scenarios are summarized in **Table 4.6**. Consequently, environmental water acquisition programs are expected to continue to exert an influence on the spot market, particularly south of the Delta.

**TABLE 4.6**
**SUMMARY OF 2030 WATER DEMANDS PRESENTED IN 2005 CALIFORNIA WATER PLAN UPDATE FOR VARIOUS DEMAND SCENARIOS**

| Scenario: | Change in Demand from 2000 to 2030 (TAF) | | |
|---|---|---|---|
| | **Current Trends** | **Less Resource Intensive** | **More Resource Intensive** |
| **Demand Type** | Current population growth, population density, and conservation trends | Current population growth, increased density, and increased conservation | Increased population growth, decreased density, and decreased conservation |
| Environmental | 494 | 987 | 0 |
| Agricultural | -3,486 | -2,818 | -1,864 |
| Urban | 2,969 | 1,365 | 5,822 |
| **Total** | **-23** | **-466** | **3,958** |

*Source: DWR 2005 California Water Plan Update, Bulletin 160-05.*

*Agricultural*

Agricultural water demands vary by region and crop type, but additional reliability is generally needed in dry years to maintain permanent crops. In Bulletin 160-05, DWR estimates that agricultural demand will generally decrease over time (about a 5 percent decrease in irrigated crop area by 2030 according to the "Current Trends" scenario presented in the plan). Planting of permanent crops, such as almonds and grapes, has significantly increased in California over the last decade. The trend toward permanent crops and the use of water-efficient irrigation measures may lead to a hardening of agricultural demand in the future. Farmers are less likely to sell supplies needed to maintain orchards and other permanent crops during dry periods, resulting in less volume and flexibility on the spot market. While agricultural water districts are increasingly entering the water market to sell supplies to urban users, a few are still seeking water supplies (such as Westlands Water District).

*Urban*

Population is the primary driver behind growth in M&I water demand. Bulletin 160-05 does not make specific estimates for future water demand, but the previous bulletin published (Bulletin 160-98)(DWR, 1998) estimates that the State's urban water demand will increase by over 3 million acre-feet (MAF) per year between 1995 and 2020. This is largely in response to increased population. The California Department of Finance (CDF) estimates that population in the state will grow by about 14 million people to a total of over 48 million by 2030. Bulletin 160-05 examined several future water demand scenarios that included population increase at, below, and above the CDF estimates, combined with various water use and conservation assumptions. These scenarios illustrate a range of potential increases in urban water demand by 2030, from 1 MAF to almost 6 MAF (see **Table 4.6**). Based on CDF population growth predictions and current demand trends, Bulletin 160-05 anticipates about a 3 MAF increase in urban water demand by 2030 (DWR, 2005).

### *Supply Considerations*

Various programs are currently examining the feasibility of developing new water supplies or increasing the reliability of existing supplies in the State. These efforts include integrated regional water management plans, conjunctive use, desalination, new surface storage, and groundwater banking projects. However, few major water supply projects are currently approved, entering construction, or in the final environmental planning stage (EIS/EIR) that would result in a significant increase in the State's water supplies, and it is difficult to anticipate what projects might be developed in the future. Projects that are under development, such as conjunctive management and recycled water, are likely to improve local supplies but may not contribute to statewide supplies. Despite the absence of new supplies on the horizon, population continues to grow and drive the demand for M&I water.

Because few significant new supplies of water are under development in California, future demands will likely be met through a combination of conservation/recycling, conjunctive management and other strategies that store excess supplies during wet periods, and reallocation from other uses. While increased conservation and recycling have the potential to slow the rate of shortages, they would also have the effect of increasing water prices. Reallocated supplies will likely move from agricultural to urban and environmental uses, facilitated by California's water markets.

#### *Groundwater*

Bulletin 160-05 indicates that California currently extracts 5.8 MAF from groundwater storage in normal years, increasing to over 14 MAF in dry years (DWR, 2005). These values are offset somewhat by the estimated 5.4 MAF returned to groundwater in wet years via recharge (both natural and active). Bulletin 160-05 also recognizes that most regions of the State are in a condition of groundwater overdraft, and reports a need for 1 MAF to 2 MAF of alternative supplies per year to eliminate groundwater overdraft, statewide. Currently, no programs are in place (or entering the environmental compliance stage) that would significantly change statewide groundwater management practices and reduce the potential for future overdraft conditions. Even with the addition of new groundwater development projects suggested in Bulletin 160-05, a statewide groundwater storage deficit is likely to remain. This suggests that in the future, it will not be possible to rely on either additional groundwater or groundwater overdraft as a reasonable resource management policy.

#### *Hydrology*

The historic hydrologic record in California generally extends back about 100 years. California's water management system was designed based on this relatively short hydrologic record. Uncertainties related to hydrology - such as the volume, timing, and location of precipitation and subsequent water supplies - are often difficult to quantify. Further, the potential impacts of climate change have yet to be seen in California's water markets, and there is much disagreement on how or when such changes might affect the State's water resources. Hydrologic variability is not addressed in this report, but may be considered as part of future risk and uncertainty analyses for the LVE.

### *Conveyance Constraints*

The Delta has become the hub of California's water management system, moving water from the water-rich north to the water-poor south. The major CVP and SWP Delta pumping facilities – Tracy and Banks pumping plants – are relied on to export or "wheel" supplies from north to south. This includes both CVP and SWP contract supplies as well as water transfers. Pumping from Tracy and Banks is limited by biological requirements and may be further curtailed when at-risk fish are present. As shown in **Figure 4.3**, CVP and SWP demand at Tracy and Banks pumping plants currently exceeds allowable pumping during the summer months.

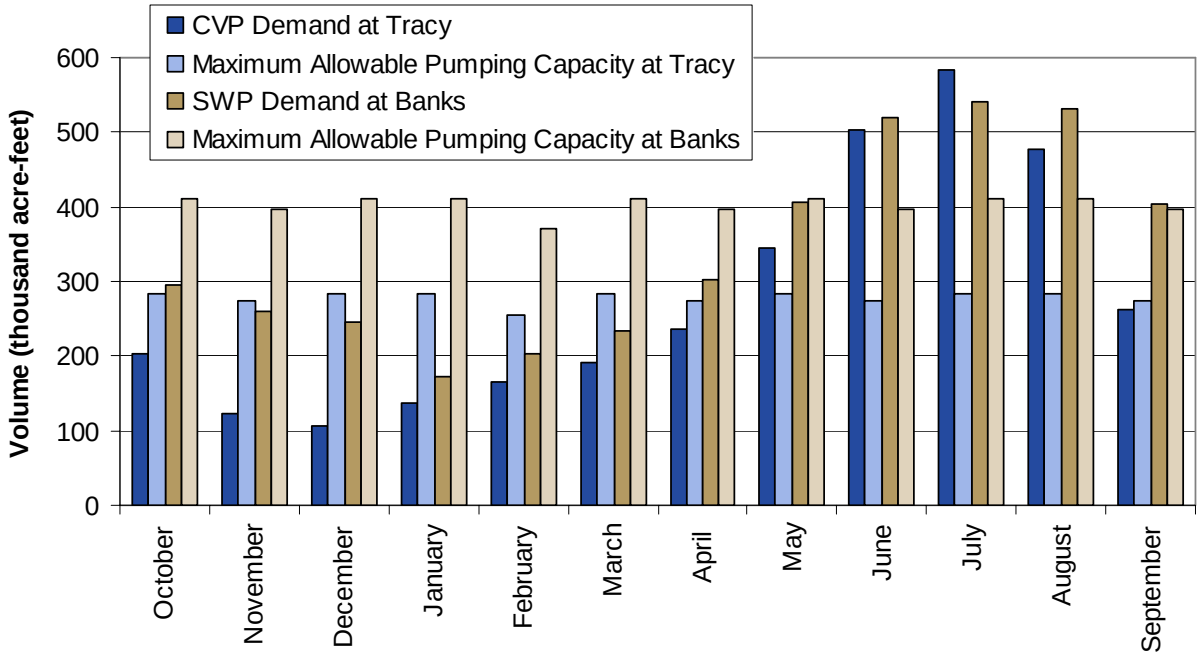


**FIGURE 4.3 – COMPARISON OF CVP AND SWP DEMANDS AND ALLOWABLE PUMPING CAPACITIES AT TRACY AND BANKS PUMPING PLANTS, RESPECTIVELY**

In recent years, instances have occurred in which capacity has not been available to transfer all desired supplies through these facilities. In 2003, for example, MWD negotiated water transfers with growers in the Sacramento Valley but was unable to move these supplies through the Delta because the conveyance system was flowing full; MWD also was unable store the water in Lake Oroville because the reservoir had filled in the late spring. These occurrences are likely to continue in the future and increase in frequency as the demand for water south of the Delta grows. Consequently, capacity at Tracy and Banks can have a considerable influence on the ability to move water south and on the subsequent price of south-of-Delta supplies on the spot market.

With pumping capacity limited, priority at the pumps also is an important factor. As illustrated in **Figure 4.4**, the highest priority is given to CVP and SWP contract supplies, followed by Phase 8 supplies, CVP and SWP contractor transfers, etc. Movement of non-CVP/SWP water transfers and environmental water has lower priority.

The EWA is granted 500 cfs of dedicated pumping capacity at Banks from July through September, or about 60 TAF per year. In comparison, the EWA's north-of-Delta water acquisition target ranges from 0 acre-feet in wet years to just over 153 TAF in critically dry years (see **Table 4.1**). In dry years, the EWA is often afforded additional capacity for transfers, but in wet years the CVP and SWP typically use all remaining Banks transfer season capacity. When EWA water cannot be transferred through the Delta, the program will typically try to store north-of-Delta purchases in CVP or SWP reservoirs until the summer (if space is available). Limits on the ability to move less costly, north-of-Delta wet year water supplies often create a need to purchase more costly south-of-Delta supplies. In addition to capacity available at the pumps, the export of supplies is limited by the capacity of the California Aqueduct and Delta-Mendota Canal.

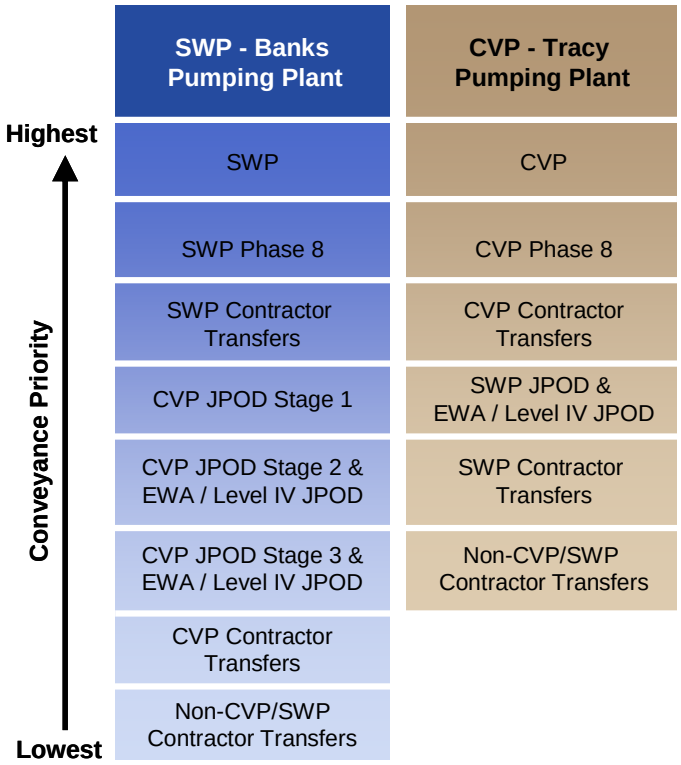


**FIGURE 4.4 – RELATIVE PRIORITIES AT CVP AND SWP DELTA PUMPING FACILITIES**

## PRELIMINARY ESTIMATION OF FUTURE SPOT MARKET WATER PRICES

The EWA relies primarily on the spot market to purchase water supplies. Because the LVE has the potential to replace south-of-Delta EWA purchases, this analysis will focus on the likely future price of south-of-Delta spot market water purchases. In the future, the EWA is likely to continue to rely on south-of-Delta purchases to meet a portion of its demands due to physical and biological constraints limiting the movement of north-of-Delta purchases; the need to replace south-of-Delta SWP supplies interrupted by pumping curtailments; and need to repay debt in south-of-Delta reservoirs.

Because it is difficult to predict how water prices on the spot market might react to changes in supply and demand over the 100-year LVE planning period, this analysis estimates EWA benefits based on a range of potential future spot market water prices. This range reflects three potential future trends in prices: (1) prices do not increase at a rate greater than normal inflation, (2) prices increase according to historical observations, and (3) prices increase at a rate greater than normal inflation. This section describes the data and methods used to estimate future spot market prices and estimate a range of potential EWA replacement supply benefits for the alternative evaluated in this report.

This discussion is presented in three parts. The first part presents an assessment of how spot market prices might respond to future increases in urban water demand in the State. The second presents interim spot market prices developed by the CALFED Common Assumptions Economic Workgroup (CAEWG) and potential future price growth trends. The third summarizes EWA replacement supply benefits estimated for each of the price growth trends.

## Assessment of Future Spot Market Conditions

In estimating future spot market prices, it is important to understand how the price of water on the spot market might respond to future disparities between water supplies and demands. The purpose of this approach is not to quantify the timing or magnitude of potential future water shortages, but rather to emphasize that under the stated assumptions, and without new water supply infrastructure, (1) M&I users will increasingly rely on the spot market to meet their future water needs, and (2) the spot market will respond to signals of supply shortage through increasing prices. The following sections present the data, assumptions, and methods used in this approach.

### *Data and Input*

Data sources for the analysis include the California Water Plan Update (Bulletin 160-05)(DWR, 2005) for water demand and supply information, demographics reports on population growth through 2050 by CDF, the 2002 State Water Project Delivery Reliability Report (DWR), and various CVP annual delivery reports. Key data parameters are summarized in **Table 4.7**.

**TABLE 4.7**
**SUMMARY OF ANALYSIS DATA AND PARAMETERS**

| Parameter | Value Used in Analysis | Source |
|---|---|---|
| **Conveyance** | | |
| Space for Transfers at Banks (6,880 cfs) | 134 TAF | CALSIM-II analysis |
| Space for Transfer at Banks (8,500 cfs) | 331 TAF | CALSIM-II analysis |
| **Water Balance** | | |
| Population | Growth rate varies over study period | California Department of Finance |
| Demand Factor (TAF per capita)[1] | 0.244 | Bulletin 160-05, Bulletin 160-98 (DWR, 2005;1998) |
| M&I Supply | 8,900 TAF | Bulletin 160-05 (Volume 3, based on year 2000 supplies delivered for M&I) |
| San Joaquin Valley SWP Table A Contracts | 1,183 TAF | State Water Project Delivery Reliability Report (DWR, 2002) |
| **Market Information** | | |
| Desalination Cost: High<br>Low | $1,200 /acre-foot<br>$800 / acre-foot | Range based on cost of desalination facilities currently planned or under construction in California |

KEY: CAEWG = Common Assumptions Economic Workgroup; cfs = cubic feet per second; EWA = Environmental Water Account; M&I = municipal and industrial; SWP = State Water Project; TAF = thousand acre-feet

*Notes:*

1. *Based on comparison of urban, industrial, and commercial water demands relative to supplies reported in Bulletin 160-05 and Bulletin 160-98. The value is adjusted downward to reflect the potential for increased conservation.*

Important analysis inputs include population growth, water demand, water supply, and conveyance constraints, as described below.

*Population Growth*

Population is a key driver of M&I water demand. **Figure 4.5** depicts potential population growth rate trends over the 100-year study period. Growth rates through 2050 are based on demographic estimates published by the CDF. Based on observed decreasing population growth in the CDF rates, two potential population growth trends are displayed after 2050 for discussion purposes: a 10 percent annual decrease in the growth rate, and a 20 percent annual decrease in the growth rate. For projections after 2050, it is assumed that population growth would not fall below zero (i.e., total population in the State would not decrease over the 100-year period of analysis).

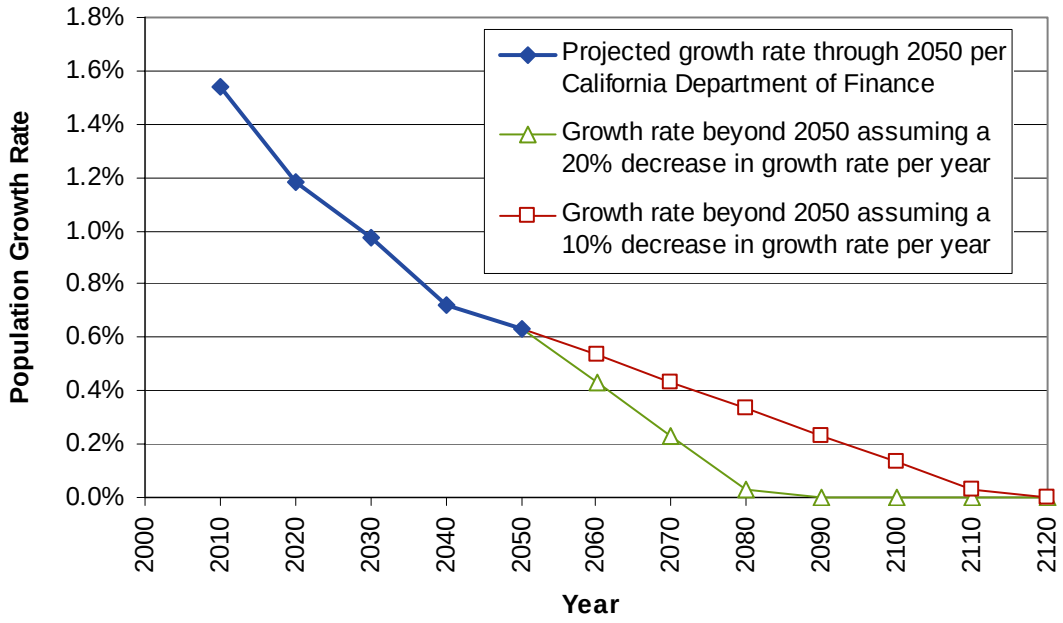


**FIGURE 4.5 – TREND IN POPULATION GROWTH OVER PERIOD OF ANALYSIS**

**Figure 4.6** depicts statewide population over the period of analysis under the growth rate trends presented in **Figure 4.5**. Between 2010 and 2050, population is expected to increase from 38.8 million to over 54 million, based on CDF projections. After 2050, the figure indicates that total population will likely continue to grow but will level off over the study period.

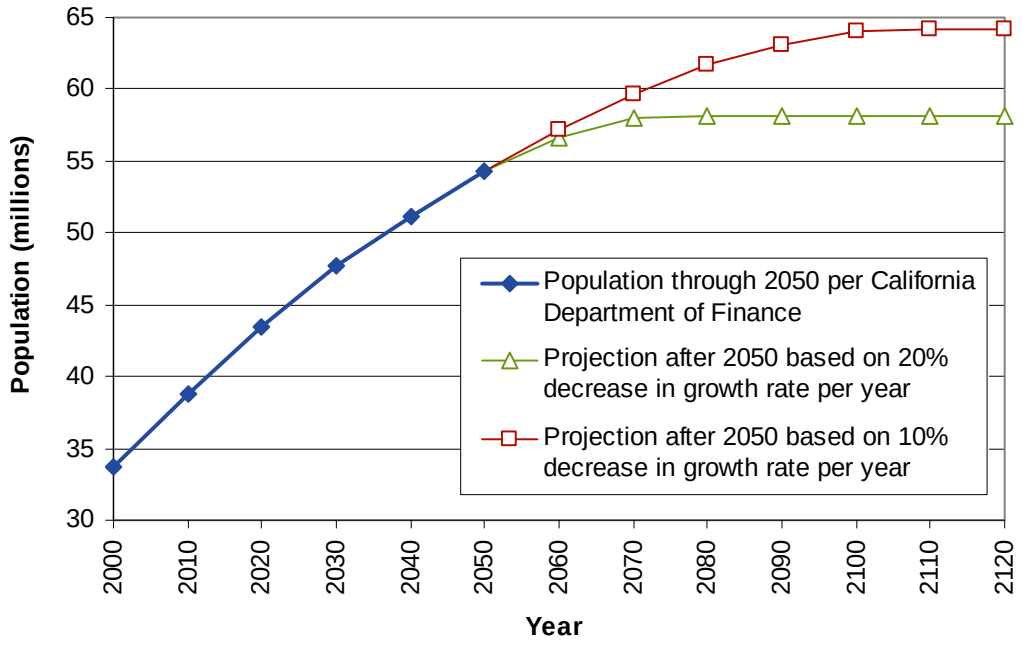


**FIGURE 4.6 – POPULATION OF CALIFORNIA OVER PERIOD OF ANALYSIS**

*Urban Water Demand and Supply*

Based on water year 2000 water demands for urban, industrial, and commercial users presented in Bulleting 160-05 (DWR, 2005), a water demand factor of 0.244 acre-feet/capita was used to calculate water demand. This factor was applied to the population sizes (shown in **Figure 4.6**) throughout the period of analysis to estimate potential future water demand. The resulting water demands, illustrated in **Figure 4.7**, are consistent with findings in Bulletin 160-05 through 2030. The growth in population, regardless of geographic location, affects the availability of water supplies statewide and creates a more competitive market.

Bulletin 160-05 (DWR, 2005) reports M&I water use in the State for 1999, 2000, and 2001. In 2001, an above normal water year, Bulletin 160-05 reports that 8.9 MAF of water were supplied to M&I users. For the purpose of discussion, this value is used as a surrogate for the volume of developed, deliverable water supplies in the State. This value, also shown in **Figure 4.7**, consists of SWP Table A contracts, CVP urban water supplies, and local water supplies. This value is used to represent available, developed water supplies because of the difficulty associated with estimating statewide water supplies and because 2000 was an above normal water year in which most contractual requests for water were met. It should be noted that the estimated 8.9 MAF does not account for hydrologic variability over the planning period. Also, the figure does not consider that, for various reasons, some M&I contractors may not have requested their full entitlements in 2000 (because demands have not been fully realized, or due to storage/conveyance limitations, for example). Further, potential exists to more aggressively use groundwater supplies, pursue higher conservation, and increase recycled water use, although it is uncertain whether these local supply measures could significantly increase statewide water availability. While it is understood that this value may not fully represent developed, available water supplies in the State for M&I use, it does provide an important indication of the potential disparity in future water supplies and demands.

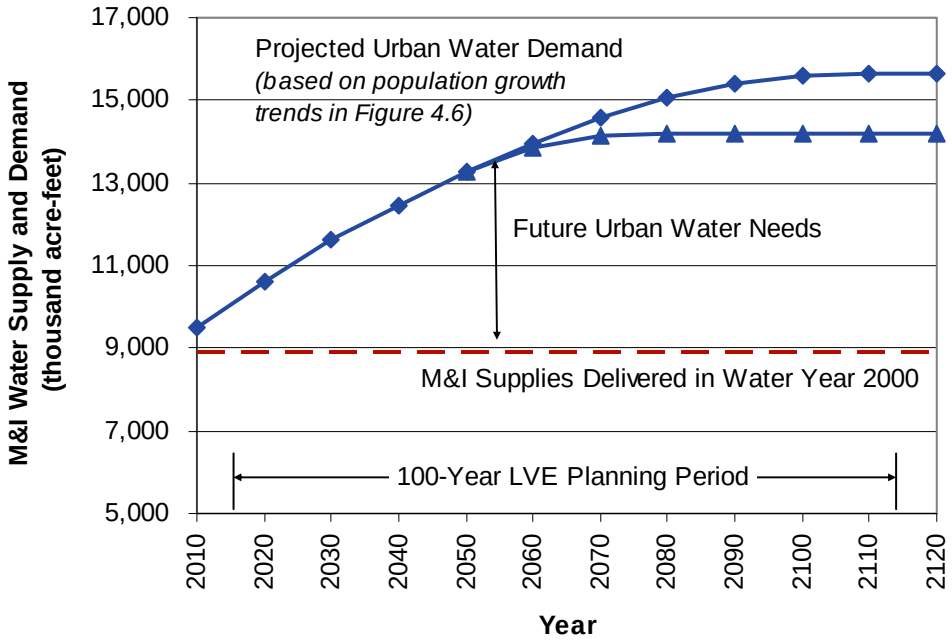


**FIGURE 4.7 – ESTIMATED M&I WATER DEMAND OVER PERIOD OF ANALYSIS**

**Figure 4.7** illustrates that future urban water needs could increase to over 6 MAF by the end of the LVE planning period due to population growth, the resulting increase in urban water demand, and a lack of new water supply infrastructure in the final development stages that would significantly contribute to State water supplies.

*Role of Transfer Markets in Meeting Water Shortages*

With an understanding that few new supplies are planned, permitted, or financed that would significantly contribute to existing water supplies, potential for supply augmentation is limited. The transfer market will grow in importance over time, largely because of its ability to move water from areas of high supply to areas of high demand. An important dynamic of water supplies is that they need to be both temporally and spatially available (water when needed, where needed). The temporal availability of water is largely a function of storage and conveyance. Without adequate storage and conveyance, excess supplies cannot be moved and stored during wet periods for later use during dry periods. The spatial availability of water is similarly affected; without adequate storage and conveyance capacity, supplies cannot be moved from water rich to water poor areas, or from high supply to high demand areas. Conveyance is already a limiting factor in the movement of water through the Delta during certain periods, an occurrence that is likely to increase in the future as more users enter the transfer market.

For users south of the Delta, reliance on north-of-Delta transfers is risky, given conveyance constraints during wet, above normal, and below normal years due to physical and environmental limitations. Once Delta conveyance constraints are reached, additional north-of-Delta supplies become irrelevant for the market. Such a condition occurred in 2003 when MWD was unable to transfer additional north-of-Delta supplies due to conveyance constraints. In addition to pumping and conveyance limitations associated with the major Delta export facilities, other conveyance

limitations may arise in the future, depending on the timing and location of demands/supplies. Use of south-of-Delta water supplies is also constrained by Table A contracts and associated transfer restrictions, particularly for meeting SWP demands.

While future M&I shortages appear likely, uncertainty exists regarding when and where shortages might be realized. **Figure 4.8** depicts the potential effect that transferring north-of-Delta water at Banks Pumping Plant capacities of 6,880 cfs and 8,500 cfs could have on potential shortages, and on the effect that transferring all SWP San Joaquin Valley Table A water to urban users could have on potential shortages. This is not to imply that San Joaquin Valley water should be transferred, but rather to demonstrate that the ability of water transfer markets to satisfy future water demands is limited by conveyance constraints and contractual agreements.

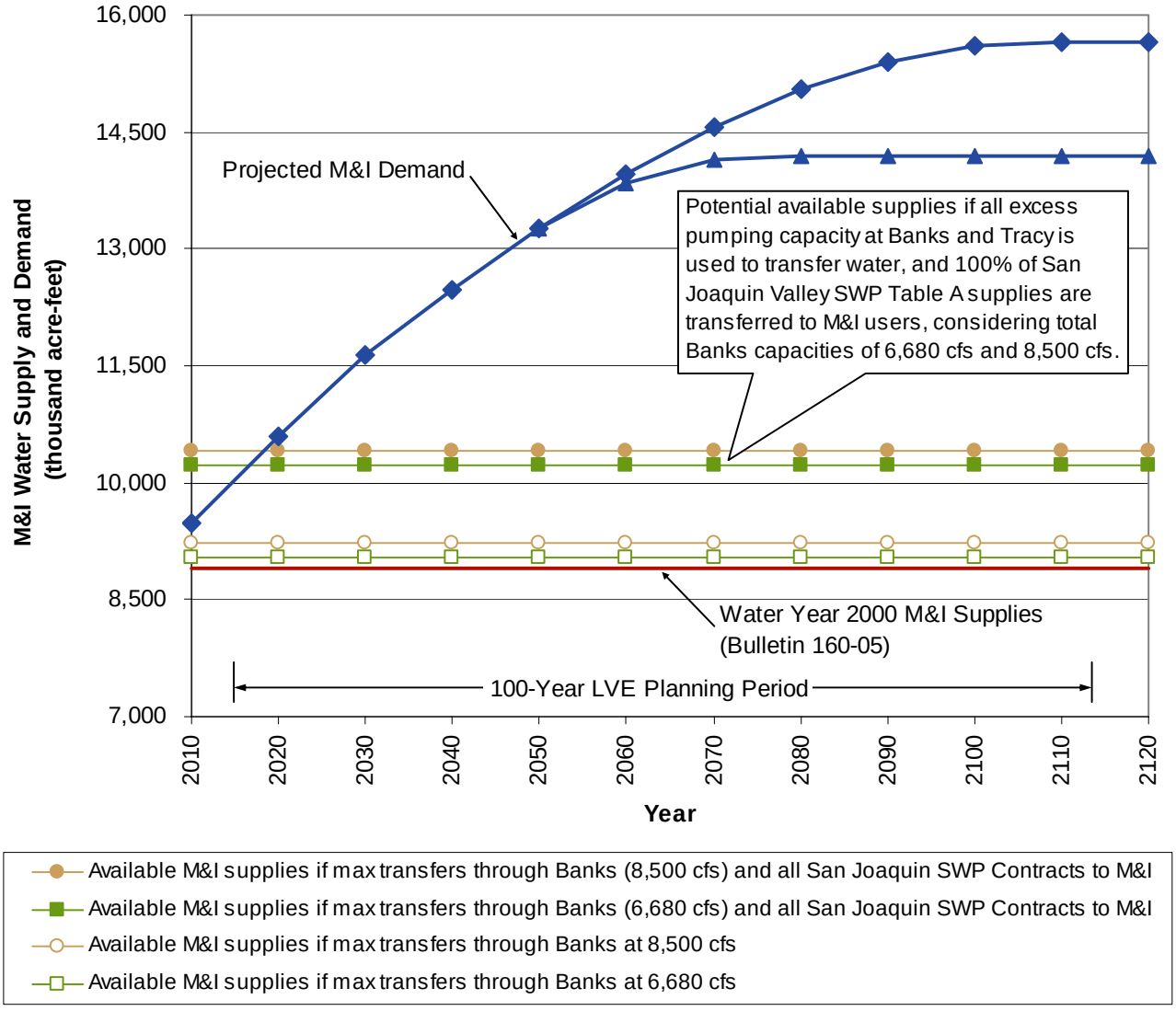


**FIGURE 4.8 – LIMITED POTENTIAL OF NORTH-OF-DELTA AND SAN JOAQUIN VALLEY SWP SUPPLIES TO REDUCE FUTURE SHORTAGES**

The implication of **Figure 4.8** is that in the future, demands will likely be greater than water supplies, and that conveyance constraints will limit the ability of north-of-Delta supplies to ameliorate the shortages. The strong assumption that all SWP Table A San Joaquin Valley water supplies would be transferred to urban uses underscores that relying on existing contracts to meet demands south of the Delta is likely insufficient.

In response to increasing urban water needs, and the deficiency of planned new supplies, urban water users will likely rely increasingly on water transfers in spot markets to bridge the gap between supply and demand. As early as 2020, traditional sources of spot market supply may be unable to respond to price signals and put more water on the market, because of conveyance and contract constraints. Unlike many other commodities subject to supply and demand, no substitutes exist for water, which is essential to life.

The implication of this finding is that as urban water demands increase, prices on the spot market will increase without significant augmentation of supply and associated conveyance improvements. As competition for water increases, prices will continue to increase. The inability of supply to respond to the growing water needs of the State will cause water prices to rise faster than the rate of inflation. That is, water prices will increase faster than the prices of other goods, due to scarcity. The effect of scarcity on water prices is built into the water market process through both demand and supply relationships. From the demand side, water is a necessary good for which there is an absolute need and no substitute. From the supply side, conveyance, hydrology, and regulatory constraints limit annual availability.

## Potential Future Spot Market Price Growth Trends

*The shortages and constraints described above suggest that the price of water in the spot market will increase over time faster than the rate of inflation.* Because it is not possible to know precisely the timing or rate at which water prices might increase in the future, three future spot market price trends are presented in this analysis: 0 percent growth rate above inflation, 1.1 percent growth rate above inflation, and 2 percent growth rate above inflation. The methods and assumptions used to estimate these price trends are described below.

The CALFED Common Assumptions Economic Workgroup (CAEWG), to support ongoing plan formulation efforts by the CALFED storage projects, has developed preliminary methodology and estimates for 2020 water market prices for use in valuing EWA benefits. While the ways in which the various CALFED storage projects could provide EWA benefits differ, the interim methodology developed by the CAEWG provides useful information for initial economic evaluations in the plan formulation stage.

The interim CAEWG estimates of EWA water acquisition prices are based on historical transfer prices, recent trends in water transfer acquisitions, and an initial estimate of the effect of acquisitions on prices. The interim estimates are intended to provide preliminary values for use in plan formulation; more detailed analyses are ongoing and/or planned to support more rigorous feasibility-level economic analyses. Interim CAEWG estimates were used to establish the starting price of water for the three spot market growth trends considered in this analysis. The CAEWG made an interim recommendation that EWA acquisition prices would increase annually by 1.1 percent over inflation, which is represented in one of the growth trends presented in this analysis.

The CAEWG estimated this real price escalator from historical EWA water acquisitions between 2001 and 2004. The analysis recognizes that the history of EWA water market transactions is limited, both in the number of transactions and hydrologic conditions experienced, and that market imperfections have occurred during this period.

CAEWG interim maximum purchase prices for 2004 development conditions (at 2004 prices) are shown in the first column of prices in **Table 4.8**. The prices are termed "maximum" because they represent the most expensive 150,000 acre-feet of EWA water purchased. These interim values have been used in this analysis based on the assumption that the LVE would replace the most expensive increment of EWA water purchases. Since the average yield of the alternative evaluated in this report (104,200 acre-feet per year) is less than the 150,000 acre-feet per year used by the CAEWG to estimate the maximum prices, use of these values may underestimate actual benefits.

The 2004 CAEWG prices were escalated to 2006 prices using the Gross Domestic Product (GDP) Implicit Price Deflator. This adjustment estimates the prices for 2004 development conditions in 2006 prices, shown in the second column of prices in **Table 4.8**. The weighted average of the estimated EWA prices is also shown in **Table 4.8**. These values reflect the percent of time each year type occurs and the average volume of EWA purchase in each year type.

**TABLE 4.8**
**INTERIM CAEWG EWA PURCHASE PRICES**

| Year Type | Frequency of Occurrence | CAEWG Interim Maximum EWA Purchase Price Per Acre-Foot, South-of-Delta | |
|---|---|---|---|
| | | 2004 Development Conditions (2004 Prices)[1] | 2004 Development Conditions (2006 Prices) |
| Wet | 28.8% | $151 | $160 |
| Above Normal | 14.0% | $172 | $182 |
| Below Normal | 19.2% | $190 | $201 |
| Dry | 16.4% | $268 | $284 |
| Critical | 2.4% | $268 | $284 |
| Driest Years[2] | 19.2% | $321 | $340 |
| **Weighted Average Price** | | **$203** | **$215** |

KEY: EWA = Environmental Water Account CAEWG = Common Assumptions Economic Workgroup

*Notes:*

1. *The CAEWG maximum price reflects the price paid for the most expensive 150,000 acre-feet of water purchased by the EWA under 2004 development conditions, expressed in 2004 dollars.*
2. *Driest years include 1924, 1929-1934, 1977, and 1987-1992.*

The interim CAWEG prices for 2004 demand conditions (at 2004 price levels) were used to estimate prices for future development conditions over the 100-year planning period (2016 to 2115), using the growth trends selected for analysis. The spot market water price was constrained by an upper bound, rather than allowing the prices to increase over time without any limit. For the purpose of this initial economic evaluation, two bounds were selected, $800 per acre-foot and $1,200 per acre-foot, reflecting the range of current estimates for the cost of desalting brackish water. These costs do not include conveyance necessary to deliver supplies to users and brine

disposal costs. Desalination often is considered as an incremental source of water supply in California. Although it is unlikely that desalination will provide all of the water needed to close the estimated gaps between water demand and supply in future, the per-unit cost of desalination is helpful as a conservative guide to the upper bound of water prices in the spot market. The anticipated water price paths, based on growth rates of 0 percent, 1.1 percent, and 2 percent above inflation, are depicted in **Figures 4.9** and **4.10**.

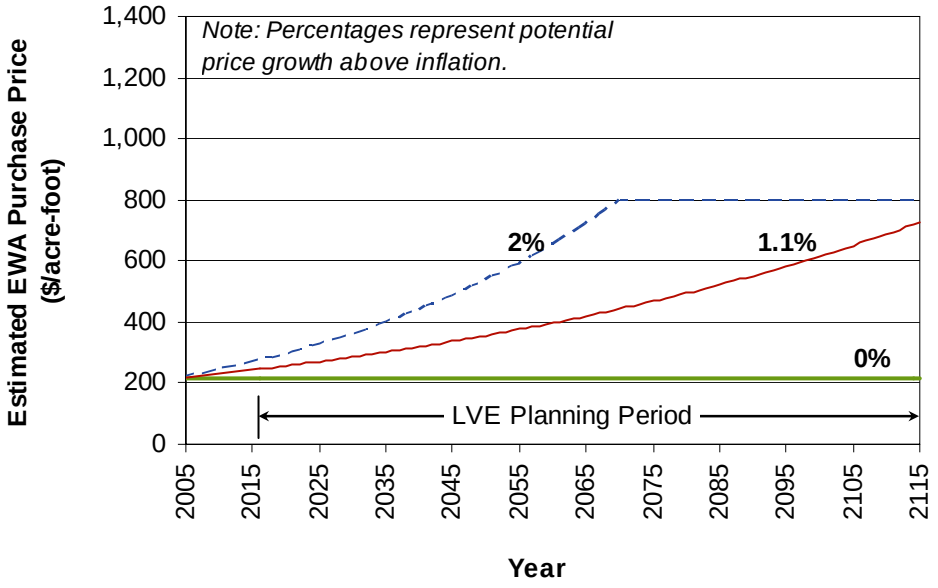


**FIGURE 4.9 – PROJECTED EWA SPOT MARKET PURCHASE PRICE OVER LVE PLANNING PERIOD WITH $800 PER ACRE-FOOT PRICE CAP**

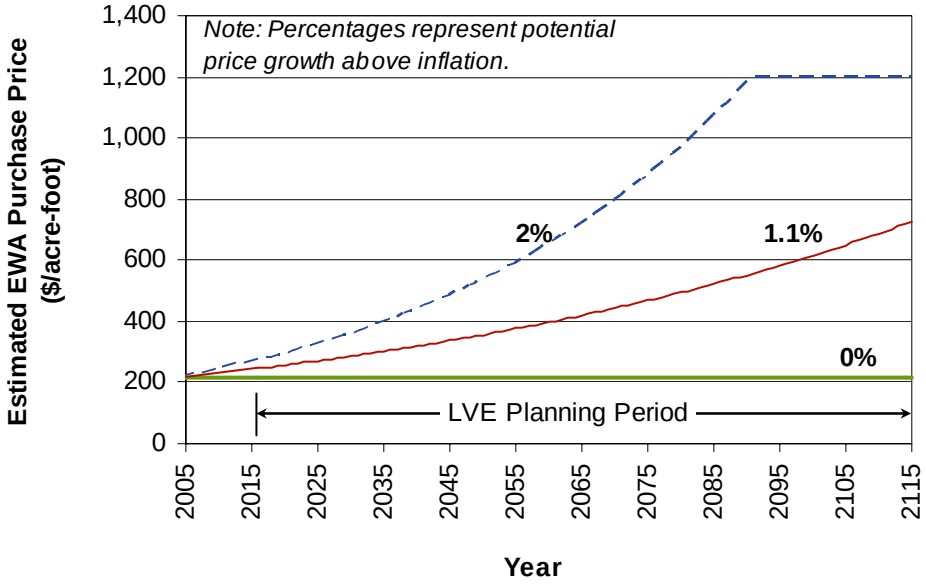


**FIGURE 4.10 – PROJECTED EWA SPOT MARKET PURCHASE PRICE OVER LVE PLANNING PERIOD WITH $1,200 PER ACRE-FOOT PRICE CAP**

The figures show that only the 2 percent price trend reached the $800 per acre-foot and $1,200 per acre-foot price caps. As described previously, each analysis uses an initial weighted average price of water in 2004 of $215 per acre-foot (2006 price levels), as shown in **Table 4.8**.

## Estimated EWA Replacement Supply Benefits

**Table 4.9** summarizes the net present value and equivalent annual benefit of the avoided costs of EWA spot market purchases for the assumed rates of future real price growth. For the 2 percent price trend, values assuming the $1,200 per acre-foot price cap are shown. These benefits were developed by applying the estimated spot market purchase prices to the estimated annual EWA deliveries for the alternative evaluated in this report (104,200 acre-feet per year, average), escalated at rates of 0 percent, 1.1 percent, and 2 percent. The 0 percent growth rate is presented as a low book end for the purpose of this initial economic evaluation, but this trend is unlikely to occur. A 4 percent growth rate was also examined as a high book end, but is not presented in the table because the lower growth rates resulted in positive net benefits. Future benefits were discounted to the base year (2016) using the current Federal discount rate of 5-1/8 percent. As shown, the average annual value of EWA replacement supplies for the alternative evaluated in the report could range from about $22.6 million to $44.5 million.

**TABLE 4.9**
**VALUE OF EWA PURCHASES REPLACED BY THE ALTERNATIVE EVALUATED IN THIS REPORT UNDER POTENTIAL FUTURE PRICE GROWTH RATES**

| | 2006 Prices ($ millions) | | |
|---|---|---|---|
| | 0 Percent Real Price Escalation | 1.1 Percent Real Price Escalation | 2 Percent Real Price Escalation |
| **Net Present Value** | $437.2 | $626.2 | $862.3 |
| **Equivalent Annual Value** | $22.56 | $32.31 | $44.50 |